(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
7 June 2001 (07.06.2001)

PCT

(10) International Publication Number
WO 01/39620 A1

(51) International Patent Classification[7]: A41D 1/04, A45F 3/20

(21) International Application Number: PCT/US99/28906

(22) International Filing Date: 6 December 1999 (06.12.1999)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/169,041 4 December 1999 (04.12.1999) US

(71) Applicant *(for all designated States except US)*: **WESLEYAN COMPANY, INC.** [US/US]; 230 Oxford Road, Kenilworth, IL 60043 (US).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **SCHNEIDER, Wesley, C.** [US/US]; 230 Oxford Road, Kenilworth, IL 60043 (US).

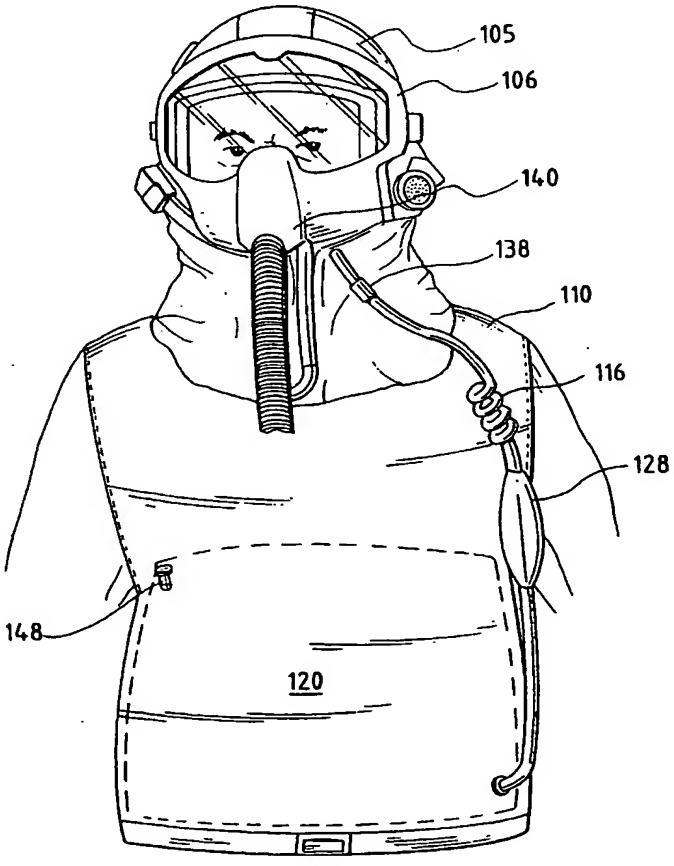
(74) Agent: **ERICKSON, Randall, T.**; Rockey, Milnamow & Katz, Ltd., Two Prudential Plaza, 47th floor, 180 North Stetson, Chicago, IL 60601 (US).

(81) Designated States *(national)*: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent

[Continued on next page]

(54) Title: GARMENT DRINKING SYSTEM



(57) Abstract: A garment drinking system worn by a user that includes a clothing article, such as a vest (110), worn on a user's body having plural layers. A fluid reservoir (120) is carried by the clothing article between two of the layers. A fluid delivery tube assembly (116) extends between the fluid reservoir to a position proximate the user's mouth, the assembly including a hand pump (128) for pumping fluid from the reservoir to the user's mouth.

WO 01/39620 A1

(AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Published:

— *With international search report.*

GARMENT DRINKING SYSTEM

Background of the Invention

This application relates generally to delivery systems for liquids and, more particularly, to a system providing for the delivery of drinking liquids to a protective mask enabling the wearer of the mask to create a closed system for ingestion without exposing the liquid to contamination.

Use of chemically active and debilitating substances requires the use of protective masks and clothing, making normal eating and drinking impossible. When using toxic chemicals, a workman may have to plan a work schedule which provides for appropriate breaks, including time to detoxify such protective clothing and allow its removal. However time-consuming and inconvenient such procedures may be, they deal with a far less life-threatening situation than that encountered by a person under attack by chemical agents. The immediacy and reliability of the protective measures required under such attacks exemplifies most sharply the inadequacies of existing liquid delivery systems. Accordingly, with the understanding that commercial, or noncombat use of the present invention is contemplated, use under combat situations will be preferably presented.

Chemical warfare has, in the past, been demonstrated to be of devastating physical and psychological effect. Chemical agents, such as toxic gases are pervasive, difficult to detect, create immediate and long-lasting disabling effects, and are available in substantial and sophisticated forms to cause a wide variety of injury and/or disability from narcosis, discomfort, and disorientation all the way to paralysis and death.

To defend against such combat measures, attempts have been made to create protective clothing and protective masks in order to insulate a wearer from the effects of offensively-utilized tactical chemical agents. Where such clothing and/or masks are effective to shield or filter the particular chemical agent involved, the wearer will be protected so long as the integrity of the protective garb remains intact.

It is characteristic of chemical agents that, once deployed, they may remain effective for a substantial period of time afterward before naturally occurring atmospheric and meteorologic action either disperses, dilutes, or removes them from the environment. As an example, certain chemical substances dispensed in aerosol form may be degraded or altered by the action of direct sunlight, while others, being water soluble, may be "scrubbed" from the atmosphere and/or landscape during rainstorms. Nevertheless, it is an accepted consequence of such forms of warfare that protective clothing, once donned, may have to be worn for an indeterminate amount of time until it is established that the danger to the wearer has abated.

Protection of the wearer is only one aspect of such protective garments. Another consideration is the ability of the wearer to carry out assigned duties even when prolonged use of such protective clothing is required. This means that such garments must not only enable the wearer to see and to communicate, but advantageously, must also make some provision for the ingestion of liquids in order to replace those liquids lost by the body through perspiration which may be heightened by the wearing of protective clothing of impermeable or semipermeable characteristics, and by increased or stimulated body reactions resulting from participation in frightening or stressful situations.

Exemplary of a protective mask designed to meet such emergency situations is the mask illustrated and discussed in U.S. Pat. No. 3,731,717, issued May 8, 1973. Other versions of such masks include a full, overlapping hood which completely covers the wearer's head, neck, and portions of the shoulders, but which depends for its effectiveness upon a system of air filtration typified by the mask shown in the above-mentioned patent.

The wearer's incoming air supply is directed through a canister containing activated charcoal or other mechanical and chemical filtering agents selected to be effective against the particular chemical agent or agents expected to be encountered. Other portions of the mask must form a substantially air-tight protective fit about the wearer's face and head. This is important because some chemical agents are absorbed not only through the respiratory system, but may enter the body through exposed skin surfaces. Transparent eye pieces are provided to enable the wearer to see through the mask, however, the rage of vision is somewhat obstructed by the nontransparent portions of the mask.

Thus, when the protective mask is properly in place, the wearer is unable to eat or drink normally without breaching the integrity of the mask's protective features. This poses a critical problem, particularly with respect to body fluids, which must be constantly and continuously replenished to avoid the serious effects of dehydration.

The above-mentioned patent provides a means by which the wearer of such a mask may ingest liquids without requiring removal of the mask. As a part of the mask construction, a mouthpiece mounted on the inside of the mask in positionable to engage

the wearer's mouth. An inlet tube attached to the mouthpiece extends through an air-tight fitting to the exterior of the mask, with the tube terminating in a plug.

A standard U.S. Army canteen is fitted with a cap having a built-in fitting to accept the plug formed at the end of the inlet tube so that when the plug is inserted into the cap, a closed system is created which includes the interior of the canteen, the interior of the cap and plug, the inlet tube, and the mouthpiece. However, use of such a system provides serious inconveniences and disadvantages which serve to complicate the procedure for obtaining such liquids and, in the case of a combat soldier, exposes the soldier to unwarranted hazards and dangers encountered during the conduct of the soldier's assigned mission.

As set forth in said patent, and as set forth in U.S. Army instruction manuals, such as No. 3-54 EL/2, at ORDG. 1038-29, pp. 2-49 to 2-50, use of the above described system requires the soldier to remove the canteen from its holder, remove the protective flap covering the canteen cap, visually located the plug at the end of the drinking tube and visually locate the cap on the canteen, insert the plug into the cap, and elevate the canteen above the level of the mouthpiece so that the liquid will flow under the influence of gravity from the canteen, down the tube, and through the mouthpiece. This type of closed system is further complicated because the canteen itself cannot be vented to the atmosphere or else the liquid contained therein will become contaminated by the chemical agent present. This means that constant flow will not take place by gravity alone.

In order to remedy this situation, the user of such a system is instructed to blow through the mouthpiece in order to inject air into the canteen, and to thereafter suck liquid

from the canteen via the drinking tube and mouthpiece. Such blowing and sucking operations are tiring and time-consuming, and seriously limit the rate at which the liquid can be drained from the canteen. Under conditions which have already created physical and psychological stress, such as those encountered on the battlefield, any additional physical effort should preferably and necessarily be avoided.

Another disadvantage of the above described system is that the user must use two hands, which means whatever activity the user is carrying out must be interrupted. The user must also raise the canteen above the level of the mouthpiece and hold it there is a tiring and awkward posture. Apart from the physical effects and consequent fatigue, this means that the user may be forced to maintain a relatively vulnerable posture in order to perform so simple an act as the taking of a drink.

When the user has finished drinking, the plug must be removed from the canteen cap, the protective flap must be sealed across the cap socket, and the canteen must be returned to its holder. During this operation, of course, the cap and plug are exposed to possible contamination by any chemical agents present in the air, and must be decontaminated prior to connection every time a drink is required.

Given the nature of certain chemical agents, the toxic effects of such agents are enhanced when they are utilized at night, particularly those agents which are degraded by higher temperatures or direct sunlight. This means that use of protective garments and liquid delivery systems for such garments may most frequently occur when visibility is at its poorest, thereby jeopardizing the secure and correct decontamination and connection of the above-described system.

The M40 series of U.S. masks and the UK S10 and FM12 mask designs use a simple connecting tube between the water bottle and the mask that will permit the flow of water between the two components using a gravity feed system. For some situations this system has a number of shortcomings. For example, the water bottle has to be held in a position above a height of a user's mouth during the drinking process. There are many operational situations, such as working in a confined space, perhaps in a tank or a helicopter, where this may be difficult to accomplish. There is also a need to blow back into the drinking tube in order to re-pressurize the water bottle back to atmospheric pressure as water is withdrawn. In addition, there is an essential requirement in contaminated environments to follow the correct procedure for coupling, uncoupling and decontamination. The procedure is effective but time consuming. Furthermore, the procedure has to be repeated with the necessary use of two hands when a user wishes to drink.

Equipment such as described in U.S.Patents 4,712,594; 4,505,310 and EP publication 0175813 B1 provide a method of making a connection between the soldier's collapsible water canteen and his gas mask when it is donned in the fully protected posture (MOPP IV). In such systems, once connected, valves are opened and this device permits the user to pump water using an in-line hand operated squeeze bulb, through a tube, to a drink conduit inside the mask. Water and electrolytes may then be consumed at will within a toxic environment without harm to the user. It is easy for the user to use one hand to locate and turn the drink tube lever and squeeze the bulb so that water can flow. In addition, the water can be supplied in any orientation or posture of the wearer, even in confined spaces. Flow rates in excess of two liters per minute have been

established, compared with half of that rate with gravity feed devices.

This equipment offers advantages to the user under operational conditions. The additional personal pressures, psychological or physiological, imposed on those personnel dressed in full protective mask and clothing, performing active operational duties in a contaminated environment, are great. Given the need under such circumstances to drink even more water than normal, perhaps double the normal (non NBC) quantity, while following fairly complicated procedures for decontamination and drinking safety, this can lead to a high level of frustration and an increased likelihood that the user will not drink sufficient water. The greater flow rate of water provided by this equipment is an important advantage.

There are many occupations in armed services and civilian jobs where breathing equipment such as gas masks or respirators may have to be worn for an extended period of time. Such occupations can include, but are not limited to: army, navy, airforce, civil defense, policeman, fireman and industrial occupations. The ability to drink at will while wearing breathing equipment is of great benefit.

Summary of the Invention

The present invention contemplates a garment which incorporates a drinking reservoir and delivery system. The garment would be particularly useful in conjunction with the wearing of a breathing device, such as a gas mask or respirator. The invention is also useful for applications where a water reservoir must be comfortably carried in a garment on a user's body and water is accessible easily though a pump and tube arrangement carried also on the body.

One embodiment of the invention is to provide an aviator with a textile combat vest that acts as a carrier for a reservoir of drinking fluid (water). A connecting tube between the reservoir and a drink tube of a mask is fitted with an in-line hand operated squeeze bulb such that water can be pumped with one hand, upon demand. The reservoir can be designed to hold a capacity of two liters of water in a closed circuit system so there is low or no possibility of contamination of the water by nuclear, biological or chemical (NBC) contaminants.

The tubing and squeeze bulb are made of butyl rubber that is resistant to penetration by chemical agents. A check valve is fitted in the bulb assembly. The main reservoir is also made of a material that is impervious to contaminants, such as chemical warfare agents. The system can match all types of NBC masks having built in connectors, either the standard US connector (i.e. ILC Dover, Inc,.) or the UK connector (i.e. Avon), by using the correct female part of the connection specific to any type selected. The squeeze bulb and the connecting tubing is positioned on the left hand side of the vest in order to maintain good compatibility with other equipment such as an inflatable life preserver worn by aircrew. Depending on the application, the squeeze bulb and the connecting tubing could be located on the right hand side.

The water reservoir is divided into channels with one inlet and one outlet with shut off valves. It is designed to be flushed-through with clean water as part of a pre-flight preparation. This process will form part of the normal procedures used for the preparation of all other flying equipment worn by aircrew.

The material preferably used for the textile vest is flame retardant, Nomex Delta T. It is designed as a "one size fits all" garment with adjustments by cords at both sides.

A zipper is located on one side to ease donning and doffing. Elasticized ribbons or an elastic panel is incorporated on the back of the vest in order to compensate for changes in volume as the drinking water is consumed. The textile vest incorporates a pocket in which the water reservoir is held on the body.

It is expected that the vest will be suitable for use by aircrew flying all types of aircraft, both fixed wing and rotary. The equipment is expected to have no limitations concerning G-forces or the 620 knot wind blast upon seat ejection.

The drinking system of the invention is very easy and practical to use. There are many practical applications for such a system including but not limited to: on board ships, in armored vehicles, in many civil defense positions, in police or fire fighting activities, or industrial occupations.

An additional chemical and/or mechanical filter may be inserted to provide an additional measure or protection against contamination of the liquid.

Hand-pumping of the bulb-type siphon pump thus provides a supply of liquid extending in a path from the interior of the liquid reservoir to the user's mouth without being exposed to the atmosphere and, thereby, any chemical agent or contaminant present.

Numerous other advantages and features of the present invention will become readily apparent from the following detailed description of the invention and the embodiments thereof, from the claims and from the accompanying drawings.

Brief Description of the Drawings

These and further aspects of the present invention may best be understood by referring to the accompanying drawings, wherein:

FIGURE 1 is a view of a prior art system showing connection of the system to a protective mask;

FIGURE 2 is a partial sectional view of another prior art system illustrating a canteen structure having an interior liner;

FIGURE 3 is a graphic illustration of the conventional prior art;

FIGURE 4 is a graphic illustration of the use of the systems of FIGS. 1 and 2;

FIGURE 5 is a partial perspective view of a prior art adapter;

FIGURE 6 is a perspective view of a prior art protective sheath;

FIGURE 7 is a partial sectional view of a prior art in-line filtration cartridge holder;

FIGURE 8 is a perspective view of a user wearing a vest with a drinking system of the present invention;

FIGURE 9 is a perspective view of the vest of FIGURE 8; and

FIGURE 10 is a view of a modified vest as shown in FIGURE 9.

Detailed Description of the Invention

While this invention is susceptible of embodiment in many different forms, there are shown in the drawing and will be described herein in detail specific embodiments thereof with the understanding that the present disclosure is to be considered as an

exemplification of the principles of the invention and is not intended to limit the invention to the specific embodiments illustrated.

Referring now to FIGURE 1, the numeral 10 indicates generally a protective mask of the type hereinabove described. Once such mask currently is distribution by the U.S. government is identified as the M17A1 mask. As an integral part of the mask structure, an inlet tube 11 extends, via voice transmitter housing 12 and fluid-tight fitting 13 to the interior of mask 10 where it is liquid tightly secured to a drinking mouthpiece not herein specifically shown. Connection of the inlet tube to the mouthpiece may be made in any number of convenient or well known manners to provide a permanent and durable liquid-tight fit. Typically, the mouthpiece is hinged and spring-biased to remain away from the user's mouth during normal conditions. An operating tab 14 extending to the exterior of mask 10 may be used to move the mouthpiece down toward the user's mouth where it may be grasped by the user until drinking is completed. Upon release, the tube will return to its original rest position within mask 10.

Inlet tube 11 is attached at its other end to bulb siphon pump 15 at fluid tight fitting 16, again, by any known method which provides a durable and liquid-tight connection. Pump 15 is preferably formed of heavyweight rubber or rubber-like material which will flex easily when compressed by the user's hand, and which will retain its liquid-tight properties over extended periods of time.

The inlet side of pump 15 is attached to supply tube 17 at fluid-tight fitting 18. Supply tube 17 may be permanently coiled about a substantial portion of its length, as shown at 19, so that it may be compactly stored yet may be extended over a relatively long distance. Supply tube 19 terminates in plug 20 which can be of a type already

known and in use, its distinguishing characteristic being that it cooperates with a socket construction 21 which can be an integral part of canteen cap 22. As an example, the plug structure shown in U.S. Pat. No. 3,731,717 may be utilized. Plug 20 may also be referred to as a cap drink pin, and socket construction 21 may also be referred to as a cap drink plug or a pin receiving plug. When assembled, plug 20 extends into canteen cap 22 . The cap 22 may include a drain tube as described in the aforementioned patents incorporated by reference.

Referring now to FIGURE 1, numeral 28 indicates a canteen construction which, is formed from a heavy gauge polyethylene-type plastic material which, when properly shaped, may be flexed many times without suffering materials fatigue and failure.

Referring now to FIG. 2, in yet another version, a canteen structure may include a more or less conventional rigid outer shell 40 within which a thin, flexible bag-like liner 41 may be disposed. The liquid to be dispensed will be contained within liner 41. Preferably, liner 41 may be of a size to fill the interior of shell 40 and extend through the neck 42 of said shell, as at 47, thereafter to be sealed off by screwing cap 22 onto the threads 43 typically formed on the exterior surface of neck 42.

As shown at 44 of FIG. 2, a valve structure, or plug, may be utilized to allow the interior of shell 40 to communicate with the atmosphere. Thus, as liquid is drawn through drain tube 45 from liner 41, liner 41 is free to collapse within rigid shell 40, allowing easy withdrawal of the liquid. Valve or plug 44 may be constructed so as to create a liquid-tight seal when in the closed position so that shell 40 may be used as a canteen in a conventional manner without a liner where protection from contaminating agents is not a consideration.

Once liner 41 is completely evacuated, it may be discarded and a fresh, sterile, liner inserted and refilled to provide another safe source of liquid.

Preferably, inlet tube 11, pump 15, supply tube 17, and plug 20 remain integral with and permanently attached to mask 10, and may be conveniently and unobtrusively stored with mask 10 in a more or less conventional carrying container.

Use of the illustrated system may be illustrated by referring to FIG. 4. After donning mask 10, the user stretches supply tube 17 to enable plug 20 to reach canteen 28 carried, for example, in holder 46. After carrying out any prescribed decontamination of plug 20 and/or cap 22, the user inserts plug 20 into cap 22 to complete a flow path from canteen 28 to the drinking mouthpiece in mask 10.

By grasping pump 15 and squeezing, liquid will then be drawn from canteen 28 and will be delivered to the user via supply tube 17, inlet tube 11, and the mouthpiece of mask 10. Such delivery requires use of only one hand to operate pump 15, and may be effected whether the user is in an upright, prone, or other position. Retainer straps 48 may be provided to anchor pump 15 to the user's clothing in order to keep the position of pump 15 constant.

Plug 20 may be left permanently attached until canteen 28 is empty, thus obviating the need to reconnect the system everytime the user wishes to drink.

FIG. 5 illustrates yet another configuration and consists of a construction including plug 20, supply tube 17, pump 15, and an adapter including a liquid-tight connection to pump 15 at one end, and a connector 49 corresponding in construction to socket assembly 21 at the other end. This version would enable attachment to the standard coupling arrangement now in use as shown in FIG. 3. Standard coupling 50

would then be connectable to adapter 49 and, thereby, to the remaining components, making immediate conversion of all existing protective masks feasible. Connection to adapter 49 may be done on an as-needed basis, under field conditions, using proper decontaminative procedures, or it could be done prior to such use on a permanent basis, to be stored with the mask. Permanent connection may be enhanced by utilizing an air-tight protective covering formed, e.g. from shrink-wrap material to prevent disconnection and as added protection from air-borne chemical agents.

In FIG. 6, a protective sheath 51 is shown intended to provide protection to supply tube 17. Sheath 51 may be insulated to counter such problems as freezing of liquid in supply tube 17 in cold weather, or preventing condensation along supply tube 17 in humid weather. Protection may also be afforded against dirt, abrasion, or kinking. Sheath 51 may be provided in a variety of colors, based upon demands of uniform coloration or camouflage, or to indicate the conditions with which sheath 51 is intended for use, such as blue for cold weather, green for humid weather, and the like.

In use, sheath 51 may be drawn over plug 20 and extend to or past pump 15, and may be stored with mask 10 until its use is required. Other sheath constructions may be openable lengthwise, as by zippers, snaps, or the like, making use of such a sheath possible even after connection to canteen 28 has been made, without requiring disconnection and attendant decontamination of couplings.

Testing and use of the disclosed pump system and the system characterized by that shown in FIG. 3 has demonstrated the increased efficiency. Test results show that liquid may be delivered to the user at twice the rate of the conventional prior art system of FIG. 3.

Provision may be made to include an additional in-line filtration element for those circumstances where the liquid itself is suspected of containing contaminating material. A cartridge type combined mechanical and chemical filter may be made a part of the present invention in a number of effective manners.

Once such filter is of the general type wherein contaminants such as microorganisms and water-borne impurities are removed in a single pass from the liquid supply to the user's mouth by packings of both activated charcoal and microbicidal resins. One such construction is described in U.S. Pat. No. 4,298,475, and is sold under the trademark POCKET PURIFIER as manufactured by Calco, Ltd., of Rosemont, Ill.

Said filtration element is preferably provided in removable and replaceable versions insertable between canteen 28 and mask 10, and may find particular usefulness where canteens may have been filled with water which requires further treatment to make it safely potable, yet the canteens which hold the water cannot be opened for purification because of the presence of airborne chemical agents.

In FIGURE 7, a filtration cartridge holder 153 is shown, adapted at one end 54 to couple with cap 22 of canteen 28, and at its other end 55 to couple with plug 20. Holder 53 may have a filtration cartridge insert 56 of the general type described above removably held therein, which may be replaced when spent. While cartridge 56 may be placed wherever convenient, one advantage to placing it at canteen cap 22 is to avoid possible contamination of the system elements downstream of canteen 22. Use or replacement of holder 53 and cartridge 56 would be subjected to the same decontamination procedures followed when attaching plug 20 to cap 22.

Figure 8 illustrates an exemplary system of the present invention that includes an article of clothing or apparel, such as a vest 110, worn by a user 105, who is also wearing a flight mask with respirator 140. The vest 110 incorporates a liquid storage and delivery system or hydration system 116. The liquid storage and delivery system is constructed in accordance with the teachings herein and of U.S. Patents 4,712,594, 4,505,310 and/or EP publication 0175813B1, all herein incorporated by reference.

As illustrated in Figure 9, the liquid storage and delivery system 116 includes a reservoir 120, an outlet tube 124, a first check valve 126a, a squeeze pump 128, a second check valve 126b, a delivery tube 134, and a connector 138, all connected together in-series for flow therethrough. The connector is shown "stowed" in Figure 9 (and shown connected to the respirator 140 in Figure 8). The delivery tube 134 is held against the vest by a strap 121 held at its end by a pull-the-dot connection 123. To use, the end of the delivery tube 134 and the connector 138 are released from the strap 121 by disengaging the pull-the-dot connection, and the connector is coupled to a facemask or respirator 140 worn by the user. The respirator has an internal drink tube or mouthpiece such as described in the aforementioned patents incorporated by reference. The supply hose and pump run on the left-hand side of the vest to minimize influence to adjacent equipment such as an inflatable life preserver and associated equipment. The rubber parts are made of butyl. The bulb includes the two check valves.

The reservoir 120 is contained between front fabric layers of the vest. The outlet tube extends from a bottom of the reservoir through a front panel of the vest.

A filling tube 146 extends from a filling point 148 through the outer panel to be flow-connected to the reservoir.

The vest includes adjustment cords 154, 156 along side seams of the vest for adjusting the fit of the vest to the user. The vest includes a zipper 158, adjacent to either one of the adjustment cords, for opening and putting on (donning) or taking off (doffing) the vest. The vest includes elastic elements or ribbons 162 (Figure 9) or an elastic panel 163 (Figure 10) spanning across a back seam. The elastic elements 162, 163 compensate for a decrease in volume due to drinking.

The vest is designed as a "one size fits all" apparel with individual adjustment cords, one on each side of the vest. The adjustment cords are laced across the side seams of the vest. The material used for the textile vest is flame retardant, Nomex Delta T. A zipper or other fastener, such as a hook and loop (VELCRO) fastener, is located on the left-hand side, or right- hand side, or both, to ease donning and doffing. Elasticized ribbons or an elastic panel is incorporated on the back of the vest in order to compensate for changes in volume as the drinking water is consumed.

The reservoir 120 is a flexible water cell, such as disclosed in the aforementioned patents incorporated by reference. The reservoir 120 can be made out of NBC resistant material such as a butyl material, with a polyethylene liner of an approved FDA grade for storage of foods. The reservoir is preferably divided into channels 121 for control of water movement during flight. The channels can be formed by baffles 122 or honeycombs within the reservoir. The reservoir can have one inlet and one outlet elbow with shut off valves to allow flushing when filling to ensure fresh water. The system 116 can have a shut off valve at the fill point of the reservoir and at a position along the delivery tube 134. The reservoir is designed like an envelope located inside the front of the vest and fastened to the textile of the vest by pull-the-dot, or buttons or snaps, and

hook and loop (VELCRO) tape. To protect the reservoir from damage, a thin perforate sheet of fabric is used.

One or more fabric flaps can be attached to the front of the vest to cover the otherwise exposed pump, tubing, and/or filling point and filling tube, to prevent these objects from being tangled or caught on external objects, such as during operation of equipment or when an aviator is ejecting from a plane.

The combat vest disclosed is only one adaptation for a combination of a drinking storage and delivery device and apparel. Many variants of apparel and vests (with different contents or accessories) are possible for different applications, both military and civilian. Such apparel include, but are not limited to: flight suit, jacket, pants, waist encircling garment, such as a girdle or belt, sash, etc. The vest of the present invention can be modified to accept other types of, or more, pockets, hook-ups, etc. to create a complete multiple function vest. The vest or other garment could be configured to hold the liquid reservoir on the user's back rather than at the front.

As an additional aspect of the invention, the garment of the illustrated embodiment of the invention provides an outer layer that conceals the reservoir to a substantial extent, providing a substantially smooth outer surface and appearance to the garment. This can provide both aesthetic and functional advantages to the garment depending on the application. This can be accomplished with or without the inner layer of the garment as long as a means for supporting the reservoir is provided.

The drinking storage and delivery systems illustrated in FIGS. 1, 2, and 4 through 7 could also be incorporated into a garment following the teaching of the present invention and FIGS. 8 through 10.

The vest of the invention is readily combinable with equipment for many types of aircrew to create practical, varied multifunctional vests. For jet pilots flying fighter aircraft with positive pressure breathing (PBG), the counter pressure vest (i.e. CSU-17) has to be located inside the vest of the invention. The pressure hose to this vest does not conflict with the vest of the invention.

The drinking device of the mask/respirator should be connected before entering an area contaminated with chemical agents under NBC conditions. The reservoir may be flushed with fresh water before flight to maintain a fresh supply of water.

From the foregoing, it will be observed that numerous variations and modifications may be effected without departing from the spirit and scope of the invention. It is to be understood that no limitation with respect to the specific apparatus illustrated herein is intended or should be inferred. It is, of course, intended to cover by the appended claims all such modifications as fall within the scope of the claims.

CLAIMS

1. A garment drinking system worn by a user comprising:

a clothing article worn on a user's body, the clothing article having plural layers;

a fluid reservoir held by said clothing article between two of said layers; and

a fluid delivery tube assembly extending between said fluid reservoir to a position proximate the user's mouth, said assembly including a pump for pumping fluid from said reservoir to the user's mouth.

2. The system according to claim 1, wherein said fluid delivery tube assembly includes a connector for connection to a facemask worn by the user.

3. The system according to claim 1, wherein said fluid reservoir comprises a collapsible container.

4. The system according to claim 1, wherein said pump comprises a bulb which is compressible by force from the user's hand.

5. The system according to claim 1, wherein said fluid reservoir is composed of a material impervious to chemical agents.

6. The system according to claim 1, wherein said pump includes a check valve.

7. The system according to claim 1, wherein said delivery tube assembly is supported on a front surface of said clothing article.

8. The system according to claim 1, wherein said clothing article comprises a vest.

9. A system for delivering liquid to a protective mask, said mask of the type having a drinking mouthpiece assembly on the interior thereof, positionable at the mouth of a user for ingestion of said liquid, said system comprising:

a vest;

a first tube liquid-tightly attached to said mouthpiece assembly;

a hand pump having an inlet and an outlet;

said first tube liquid-tightly attached to said outlet;

a second tube, one end of which is liquid-tightly attached to said inlet;

a liquid reservoir located within a compartment of said vest for storing a quantity of said liquid therewithin;

said liquid reservoir including a connection to join said remaining end of said second tube liquid-tightly thereto;

said liquid reservoir, said connection, said second tube, said pump, said first tube and said mouthpiece defining a liquid flowpath through which liquid may be withdrawn from said liquid reservoir.

10. A system for delivering liquid to a protective mask, said mask of the type having a drinking mouthpiece assembly on the interior thereof positionable at the mouth of a user for ingestion of said liquid, and an inlet tube liquid-tightly attached to said mouthpiece and extending outside said mask, said system comprising:

an article of clothing;

a hand pump, the outlet of which is liquid-tightly attachable to said inlet tube;

a supply tube liquid-tightly attached to the inlet of said pump;

a collapsible liquid reservoir for storing a quantity of said liquid therewithin, held within said article of clothing;

said liquid reservoir liquid tightly connected to said supply tube.

11. The system according to claim 1, wherein said reservoir comprises channels to control the movement of liquid therein.

12. A garment drinking system worn by a user comprising:

a clothing article worn on a user's body, the clothing article having an outer layer;

a fluid reservoir held by said clothing article inside said outer layer; and

a fluid delivery tube assembly extending between said fluid reservoir to a position proximate the user's mouth, said assembly including a pump for pumping fluid from said reservoir to the user's mouth.

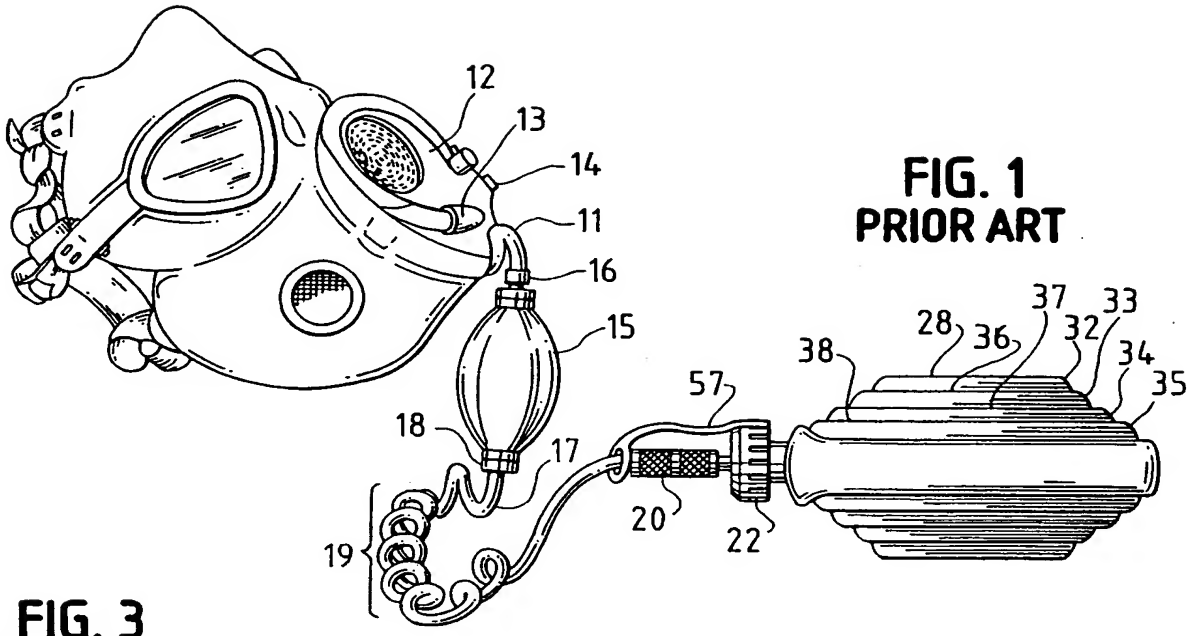


FIG. 1
PRIOR ART

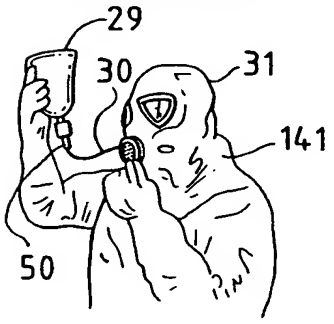


FIG. 3
PRIOR ART

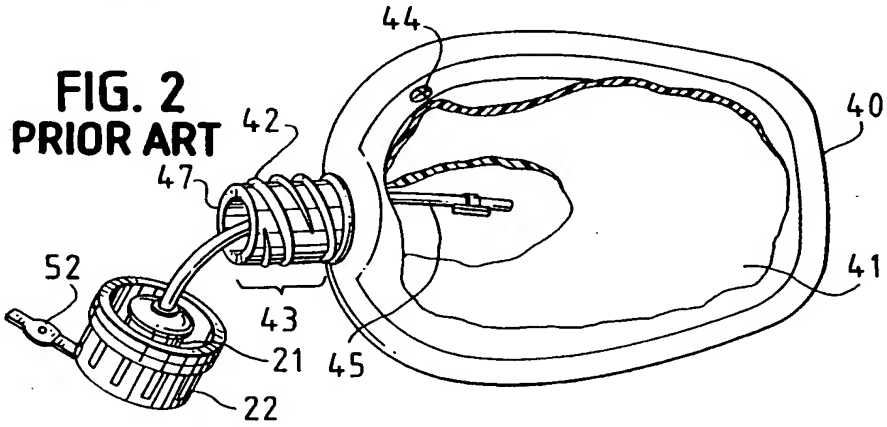


FIG. 2
PRIOR ART

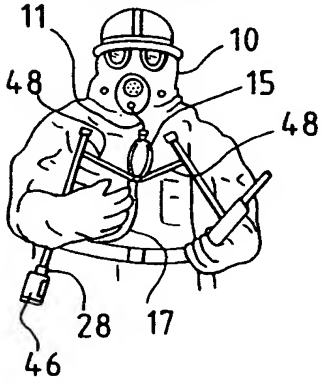


FIG. 4
PRIOR ART

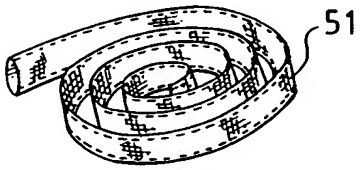


FIG. 6
PRIOR ART

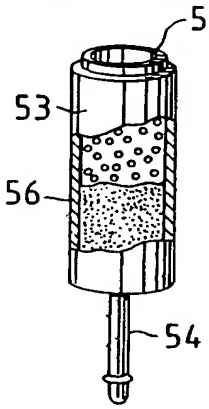


FIG. 7
PRIOR ART

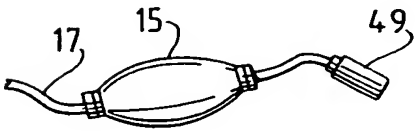


FIG. 5
PRIOR ART

FIG. 8

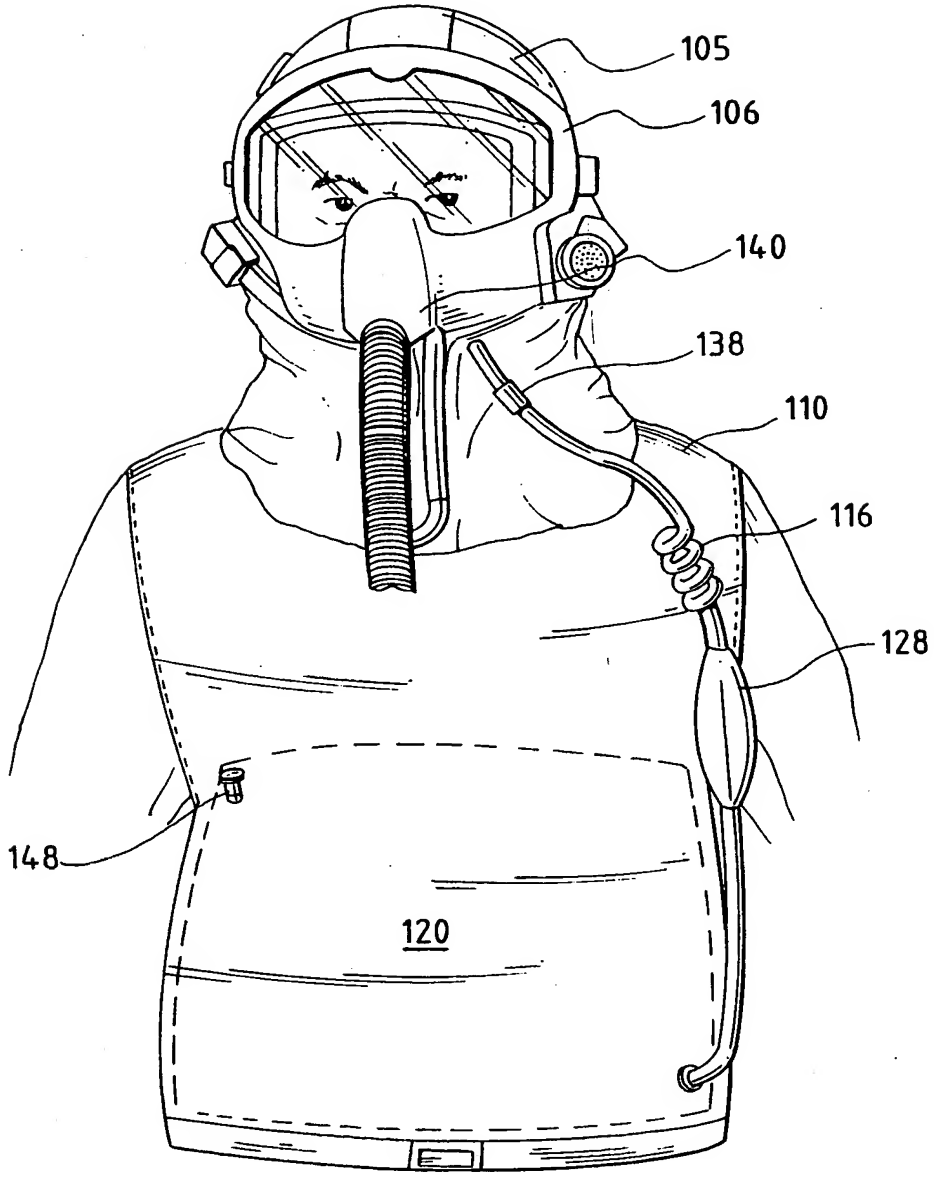


FIG. 9

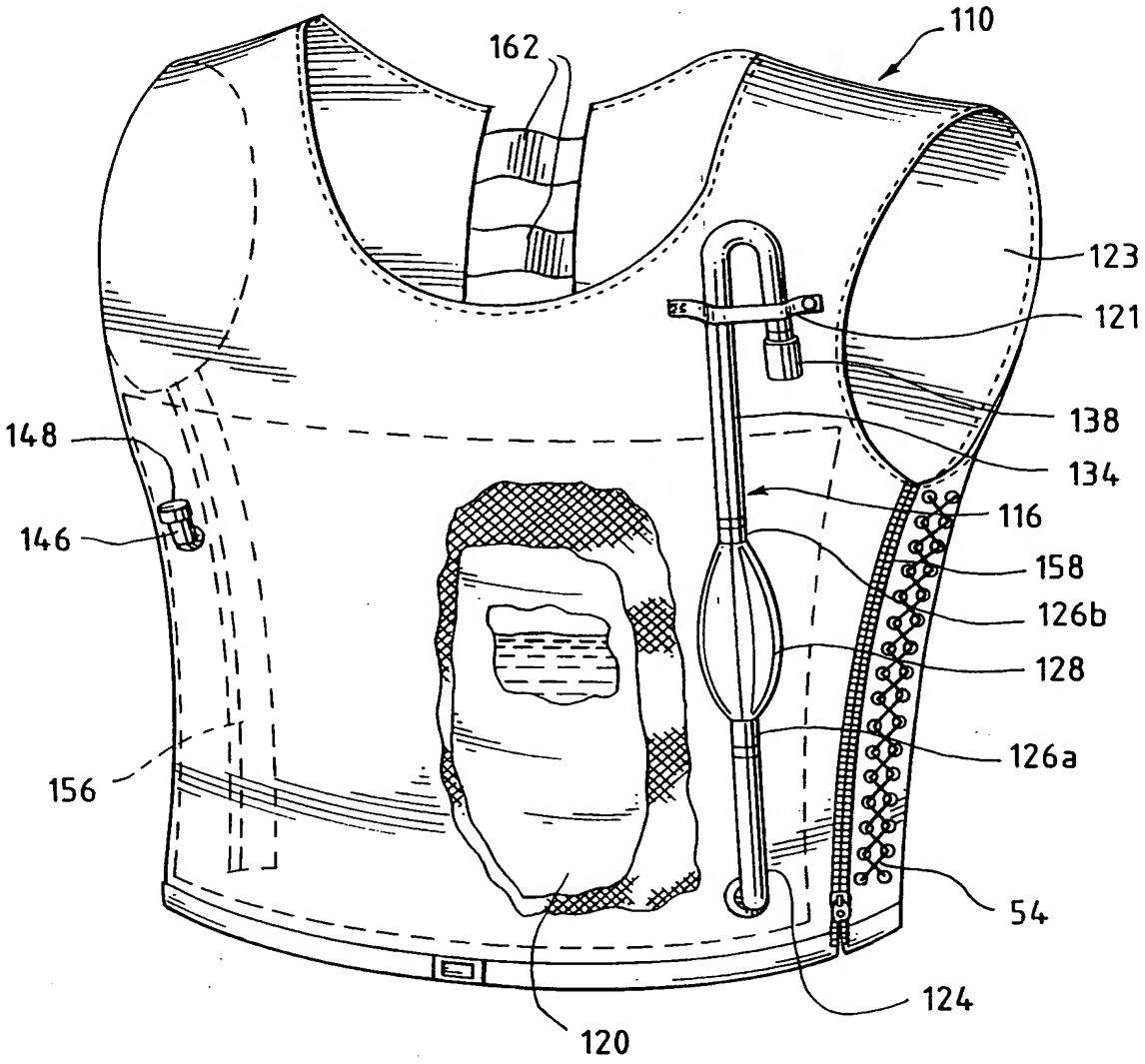
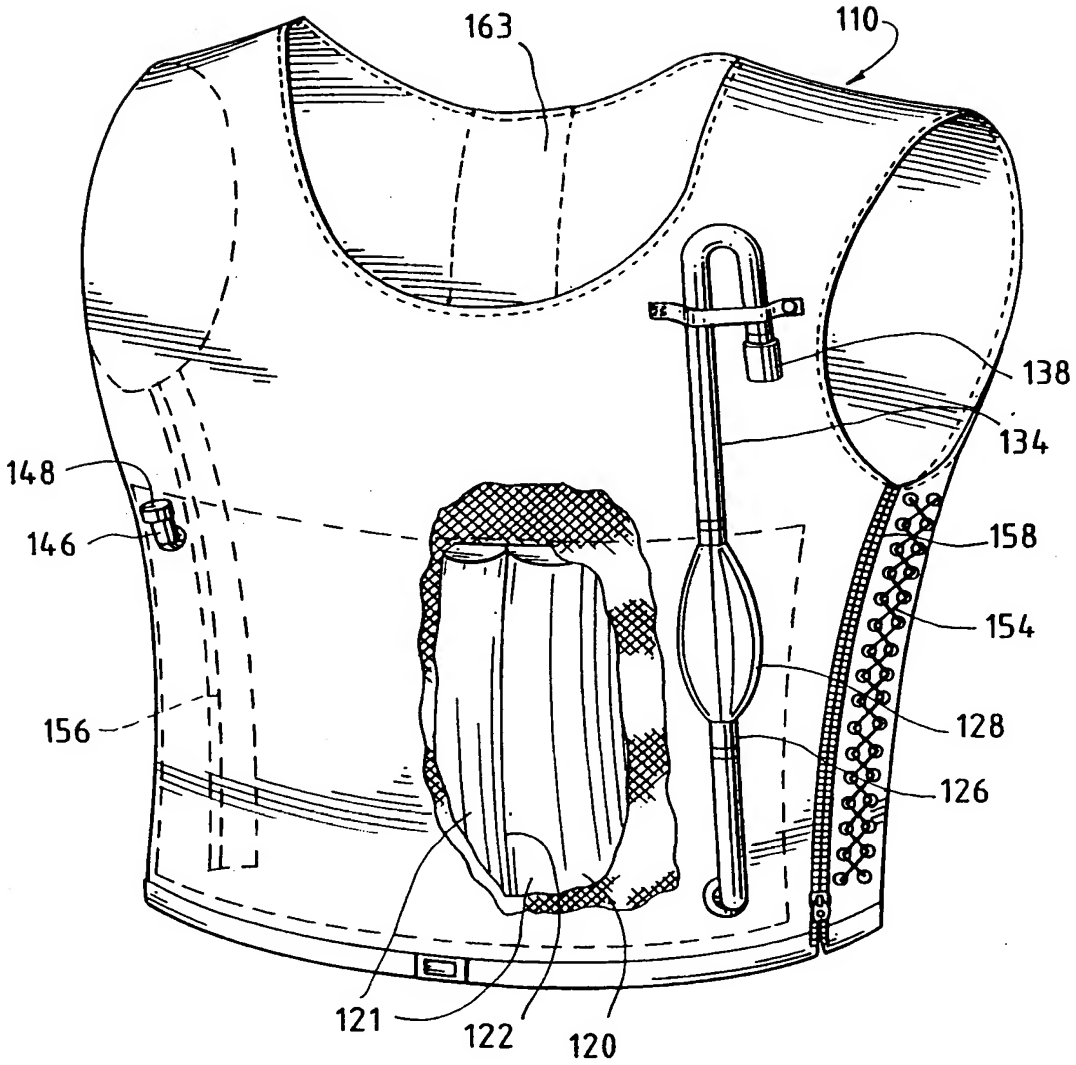


FIG. 10



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US99/28906

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :A41D 1/04; A45F 3/20
US CL :2/102; 224/148.2; 222/175
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 2/102, 94, 108, 115; 224/148.2; 222/175; 141/114, 379; 128/206.22

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WEST: vest, drink$3, mask

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,864,880 A (ADAM) 02 February 1999, col. 3, lines 28-38, col. 4, lines 60-67, Fig. 1.	1, 3-8, 11, 12
Y	US 5,282,557 A (MCCOOK) 01 February 1994, col. 4, line 57 through col. 5, line 3.	1, 3-8, 11, 12
A	US 4,948,023 A (TRIPP) 14 August 1990.	1-12
A	US 5,722,573 A (CARNEL) 03 March 1998.	1-12
A	US 6,000,395 A (BROWN) 14 December 1999.	1-12
A	US 4,712,594 A (SCHNEIDER) 15 December 1987.	1-12

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search	Date of mailing of the international search report
14 MARCH 2000	10 MAY 2000
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer AMY VANATTA Telephone No. (703) 308-0861

Form PCT/ISA/210 (second sheet) (July 1998)★

BNSDOCID: <WO___0139620A1_I_>